



US Army Corps
of Engineers
Vicksburg District

FLOOD CONTROL, PEARL RIVER BASIN, MISSISSIPPI

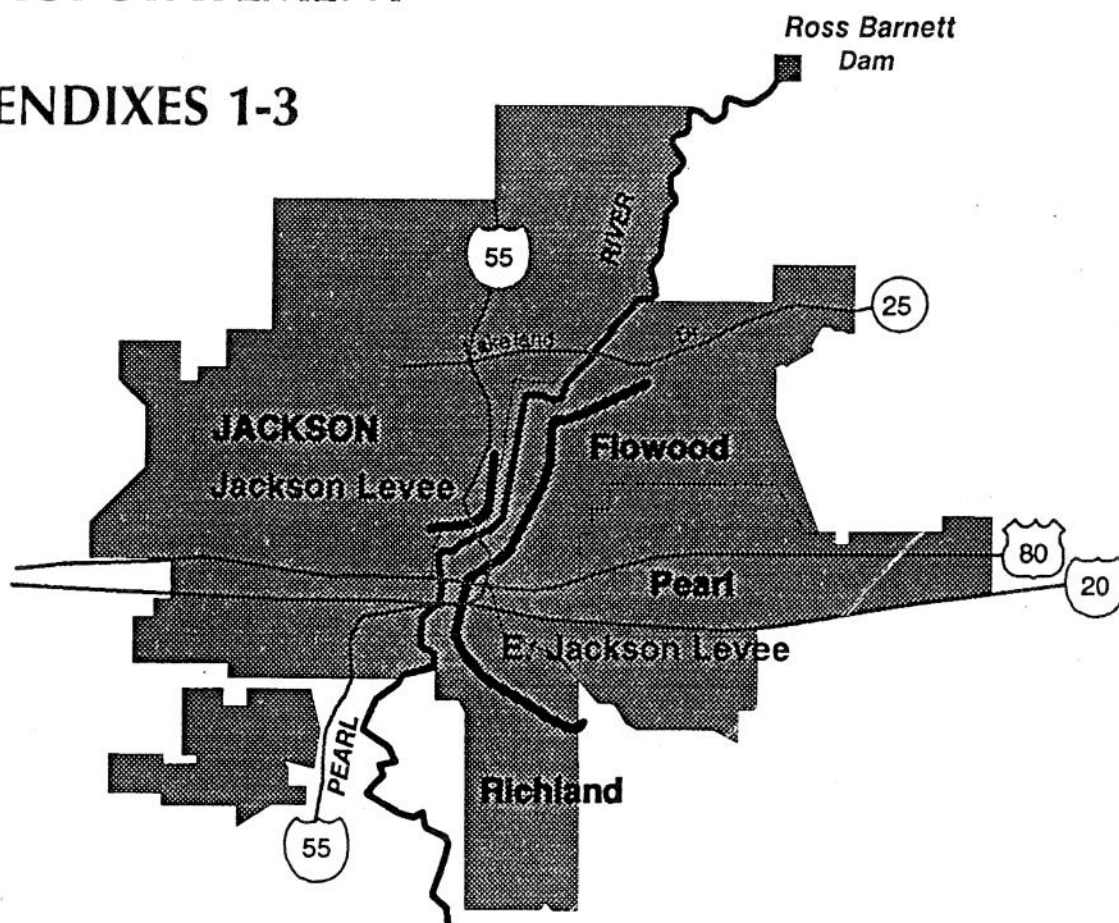
JACKSON METROPOLITAN AREA, MISSISSIPPI

FEASIBILITY REPORT VOLUME I

MAIN REPORT

DRAFT ENVIRONMENTAL
IMPACT STATEMENT

APPENDIXES 1-3



DRAFT

JANUARY 1996

JACKSON METROPOLITAN AREA, MISSISSIPPI

MAIN REPORT

JANUARY 1996

U.S. ARMY CORPS OF ENGINEERS
VICKSBURG DISTRICT
VICKSBURG, MISSISSIPPI 39180

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JACKSON METROPOLITAN AREA, MISSISSIPPI
FEASIBILITY REPORT

STUDY AUTHORITY

1. Studies of the Jackson Metropolitan Area, Mississippi, were authorized by congressional resolutions adopted 9 May 1979. These authorizations read as follows:

"Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on Pearl River Basin, Mississippi and Louisiana, published as House Document Number 282, Ninety-Second Congress, Second Session, and other pertinent reports, with a particular view toward determining whether any further improvements for flood damage prevention and related purposes are advisable at this time. The alternatives are to be reviewed with local interests to insure a viable, locally supported project.

Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the Pearl River and Tributaries, Mississippi, contained in House Document 441, 86th Congress, and other reports with a view to determining whether measures for prevention of flood damages and related purposes are advisable at this time, in Rankin County, Mississippi.

Resolved by the Committee on Environment and Public Works of the United States Senate, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, and is hereby requested to review the reports of the Chief of Engineers on Pearl River Basin, Mississippi and Louisiana submitted in House Document Numbered 92-282, 92nd Congress, 2nd Session and other pertinent reports with a view to determining whether any further improvements for flood damage prevention and related purposes are warranted at this time."

2. Authorization for construction of Shoccoe Dam is contained in Section 401(e) of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662) which reads as follows:

"(3) PEARL RIVER BASIN, INCLUDING SHOCOCOE, MISSISSIPPI.--

The Secretary is authorized to construct a project for the purpose of providing flood control for the Pearl River Basin in Mississippi, including, but not limited to, Carthage, Jackson, Monticello, and Columbia, Mississippi, consisting of--

(A) the project for flood control, Pearl River Basin, Mississippi: Report of the Chief of Engineers, dated March 17, 1986, at a total cost of \$80,100,000, with an estimated first Federal cost of \$56,070,000 and an estimated first non-Federal cost of \$24,030,000; and

(B) for the purpose of providing flood control for the upstream areas of the Pearl River Basin in Mississippi--

(i) a combination roadway crossing of the Pearl River and floodwater detention and storage facility in east central Leake County, Mississippi;

(ii) a levee system in the south part of Carthage, Mississippi, which will upgrade, extend, and improve the protective levee system on the south side of Highway 16 in Leake County and the city of Carthage;

(iii) appropriate drainage structure and bridge modifications to expand and improve the stormwater conduits under Mississippi Highway 35, south of Carthage, Mississippi, for the purposes of reducing backwater influence for areas upstream of such highway;

(iv) upstream reservoirs on the Pearl River;

(v) such other structures as may be necessary to alleviate unforeseen flooding in the Leake County area as a result of the construction of the Shoccoe Dry Dam; and

(vi) channel improvements on the upstream Pearl River. For purposes of analyzing the costs and benefits of those portions of the project described in subparagraph (B), the Secretary shall take into account the costs and benefits of that portion of the project described in subparagraph (A)."

STUDY PURPOSE AND SCOPE

3. This report discusses the findings of feasibility studies authorized for the Jackson Metropolitan Area, Mississippi. These studies were conducted in coordination with the Pearl River Basin Development District (PRBDD)--the study sponsor.

4. The overall document is comprised of a main report, a draft Environmental Impact Statement (DEIS), and supporting documentation. The main report consists of problem identification, plan formulation, description of the selected plan, and recommendations. The DEIS discusses anticipated effects of the proposed work. The supporting documentation includes technical appendixes. The report has been prepared in general accordance with Engineering Regulation 1105-2-100, "Guidance for Conducting Civil Works Planning Studies," (28 December 1990).

5. Previous studies conducted as a part of the Comprehensive Pearl River Basin Study found Shoccoe Dam to be the best plan to address flooding problems in the Jackson Metropolitan Area. Shoccoe Dam was authorized for construction by WRDA 86, but was subsequently determined to be unimplementable from a local interest standpoint. PRBDD and Hinds County Board of Supervisors requested the U.S. Army Corps of Engineers, Vicksburg District, undertake an investigation of alternative flood control measures. Reconnaissance studies for the

Jackson Metropolitan Area were completed in June 1990. These studies focused on evaluation of a comprehensive levee system consisting of approximately 24 miles of new levees and raising approximately 11 miles of the existing levees. Reconnaissance studies indicated that feasibility studies were warranted and a Feasibility Cost-Sharing Agreement (FCSA) was executed with PRBDD on 25 September 1991.

STUDY AREA DESCRIPTION

GENERAL

6. The Pearl River Basin, as shown on Plate 1, is located in the southern central portion of Mississippi and in a small part of southeastern Louisiana. The primary study area comprises the Pearl River Basin between River Mile (RM) 270.0 just south of Byram, Mississippi, and RM 301.77 at the dam of Ross Barnett Reservoir. Municipalities within the study area include Jackson, Flowood, Pearl, and Richland. The study area includes parts of three counties--Madison, Hinds, and Rankin. Major tributaries of the Pearl River within the study area include Richland, Caney, Lynch, Town, and Hanging Moss Creeks. This area is shown on Plate 2.

PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS

CORPS STUDIES AND REPORTS

Survey Report Recommending Existing Levee Project

7. A survey study of the Pearl River and Tributaries, Mississippi, was authorized by the Chief of Engineers on 2 May 1949. The survey report was submitted to the South Atlantic Division Engineer by the Mobile District Engineer on 30 June 1959 and recommended a system of levees for Jackson and east Jackson in combination with channel cutoffs and improvements between the levees. Authority for construction of these works is contained in Section 203 of the Flood Control Act of 14 July 1960, Public Law 86-645. Construction was completed in 1968.

Comprehensive Survey of the Pearl River Basin, Mississippi and Louisiana

8. A comprehensive study of the water and related land resources of the Pearl River Basin was completed in 1970 by the Corps in cooperation with the Departments of the Interior; Agriculture; Health, Education, and Welfare; Transportation; Commerce; the Federal Power Commission; and the States of Mississippi and Louisiana. The resulting comprehensive plan included structural measures in two categories--an early action program and a framework for future planning. In addition, nonstructural measures were recommended in the area of flood plain management, agricultural land and forest management,

health, water quality, recreation, fish and wildlife enhancement, preservation of natural areas, data collection, and review of water resource programs and policies. Structural measures in the early action program included three multiple-purpose reservoirs (Ofahoma, Carthage, and Edinburg), land treatment measures, and a pleasure boatway over 302 miles of the Pearl River.

Edinburg Dam Phase I Design Memorandum (DM)

9. A followup report on the Ofahoma, Carthage, and Edinburg Dam projects was completed by the Mobile District in January 1972 and published as House Document 92-282, 2d Session. It was concluded in that report that only the Edinburg project was economically justified.

10. Phase I DM planning studies on the Edinburg project were authorized in WRDA 74. A special report which provided a brief economic analysis of the project was furnished to Congress in September 1980 in response to a provision in Report Number 96-1086 of the House of Representatives on the Supplemental Appropriations and Recision Bill of 1980. The reevaluation of the Edinburg project in that report indicated that the project was no longer economically justified due to increases in project costs resulting from errors in the preliminary topographic mapping used in the 1970's and changes in water resources policy which resulted in reductions in project benefits. Nevertheless, the Edinburg project, as well as the Ofahoma and Carthage projects, were reevaluated in the Pearl River Basin Interim Report on Flood Control discussed in paragraph 12.

Town Creek, Jackson, Mississippi

11. A survey report on the feasibility of flood protection measures on Town Creek at Jackson was completed in August 1970. The conclusion in that report was that no economically feasible flood control plan for Town Creek could be identified. This report was returned for reevaluation and the authorities requesting that investigation were combined with other authorities responded to in the Pearl River Basin Interim Report on Flood Control discussed in paragraph 12.

Pearl River Basin Interim Report on Flood Control

12. Following the Easter flood of 1979, numerous House and Senate resolutions were passed directing review by the Corps of various water resource problems in the Pearl River Basin. A comprehensive basin study was initiated to address these resolutions in addition to others which had been previously funded.

13. A reconnaissance report was completed by the Mobile District and approved in November 1981. This report recommended more detailed evaluation of various flooding problems in the Basin to be documented in an interim report on flood control.

14. The 1981 reconnaissance report identified four flood control project elements which appeared economically feasible. These elements were referred to as the "Four Point Plan" and consisted of constructing a wave barrier in the Ross Barnett Reservoir, clearing the floodway below the levees in Jackson, constructing a river bend cutoff through the old sanitary landfill in south Jackson, and removing sediment deposit at the Highway 25 crossing on the Pearl River.

15. The Four Point Plan was authorized for construction in the FY 83 Supplemental Appropriations Bill. Detailed studies indicated that the river bend cutoff was not incrementally justified and was therefore deleted from the plan. The work at Ross Barnett Reservoir was deleted because of a lack of Federal interest. The Highway 25 work was completed by PRBDD and was reimbursed for the Federal share of these costs. Detailed studies showed the clearing plan should be reduced in scope. DM No. 1, "Flood Control for Jackson, Mississippi," May 1984, contained documentation for the Four Point Plan.

16. "The Pearl River Basin Interim Report on Flood Control," July 1985, recommended construction of a dry dam in the vicinity of Shoccoe, Mississippi. WRDA 86 authorized construction of Shoccoe Dam. Due to opposition from upstream interests, Shoccoe Dam is not implementable.

Slidell, Louisiana, and
Pearlington, Mississippi

17. An interim report on flood control for Slidell, Louisiana, and Pearlington, Mississippi, was prepared by the Vicksburg District in March 1985. Flood control improvements in Slidell were authorized by Congress in the Supplemental Appropriations Act of 1985 (Public Law 99-88) and in WRDA 86 (Public Law 99-662). The plan of improvement consists of a 4.5-mile levee system providing 200-year protection to subdivisions north of Interstate 10 and a 10.5-mile levee system providing 200-year river and hurricane protection to many of the subdivisions south of Interstate 10. The cost of the recommended plan of improvement is approximately \$39.8 million and will protect some 3,029 existing structures in the project area. A General Design Memorandum (GDM) was prepared in 1992, but has not been approved due to inability of the local sponsor to provide local requirements. Efforts are still ongoing by the sponsor to secure adequate financing.

Carthage/Leake County, Mississippi.
Interim Flood Control Report

18. Studies to determine the feasibility of flood control measures for Carthage were completed in February 1987. Carthage experiences some flooding from backwater from the Pearl River and from Town Creek, a tributary of the Pearl River which flows through Carthage. Alternatives evaluated included channel improvements and levees. WRDA 86 authorized construction of Shoccoe Dam and additional flood control measures in Leake County and Carthage. The

findings from this study were incorporated into the GDM for Shoccoe Dam. None of the alternatives evaluated for Carthage, Leake County, were economically feasible.

Columbia and Picayune, Mississippi,
and Bogalusa, Louisiana, Interim
Flood Control Report

19. Studies to determine the feasibility of flood control measures for the urban areas of Columbia, Picayune, and Bogalusa were completed in February 1989. These cities experience flooding both from backwater from the Pearl River and from tributaries of the Pearl River. Alternatives evaluated included channel improvements, small dry dams, and levees. Results of these studies indicated that none of the plans evaluated were economically justified.

Caney Creek, Mississippi

20. Reconnaissance studies were conducted to investigate urban flood damage reduction and bank stabilization along Caney Creek in southwest Jackson. The reconnaissance study was completed in November 1990. No economically justifiable plan was identified, and further studies were not recommended.

CONTINUING AUTHORITIES, SECTION 205

21. Three flood reconnaissance investigations were conducted under the authority of Section 205 of the Flood Control Act of 1948, as amended. In 1979, the Mobile District investigated flooding along Richland Creek in Rankin County. This investigation showed that protection of existing development from headwater floods was not economically justified.

22. Flood problems in Mendenhall, Mississippi, were evaluated by the Mobile District in an October 1984 Section 205 Detailed Project Report on Sellers Creek. Measures evaluated included flood plain evacuation, clearing and snagging, upstream impoundments, and channel modifications. None of the plans were economically justified.

23. The Vicksburg District investigated flooding problems in Pearl and Flowood. A plan consisting of approximately 2 miles of channel enlargement on a tributary of Neely Creek was recommended in the Detailed Project Report submitted in May 1988. The project was later discontinued due to the inability to execute a Local Cooperation Agreement (LCA) with the project sponsor.

OTHER CORPS FLOOD-
RELATED INVESTIGATIONS

24. Other Corps flood-related reports are as follows:

Dam Safety Report, 1981
Caney Creek Flood Insurance Administration (FIA) Report, 1969
Hanging Moss and White Oak Creeks FIA Report, 1975
Hobolochitto Creek and East and West Hobolochitto Creeks
FIA Report, 1975
Lynch Creek FIA Report, 1971
Pearl River and Neely Creek FIA Report, 1973
Purple Creek FIA Report, 1968
Strong River and Sellers and Terrapin Creeks FIA Report, 1974
Yochanookany River, Dye Ditch, and Munson Creek FIA Report, 1972

STUDIES BY OTHERS

Department of Agriculture Studies

25. The Soil Conservation Service (SCS), under authority of Public Law 83-566, participated with the Mobile District's study of the Pearl River Basin during the 1983 timeframe. One component of this study involved the identification of potential reservoir sites above Jackson for floodwater storage. These sites are discussed in more detail under the Plan Formulation section of this report.

26. SCS has several investigations currently underway in the Pearl River Basin. These are all in the preliminary stages. They include evaluations of flood problems on Sellers Creek in Mendenhall, Town Creek in Carthage, Magees Creek in Tylertown, and certain tributaries in Columbia, Mississippi. The Corps has closely coordinated with SCS regarding these investigations and has provided data from previous Corps studies for SCS use.

Studies by Local Interests

27. There have been numerous flood control studies on the Pearl River conducted by local interests. PRBDD, the local sponsor for the project, retained local engineering firms to develop seven major studies as follows:

a. Michael Baker Engineering Company's 1981 reports on extension of the existing levee system in the Jackson area; Hinds-Rankin levee south and channel improvement; levee system alternatives for Columbia, Monticello, and Morgantown; Jackson highways, railroads, and other encroachments; flood relief in the Jackson, Mississippi, area obtainable by selective clearing; and U.S. Highway 98 at Columbia.

b. Harza Engineering Company's 1982 report on upgrading the Ross Barnett project for flood control.

c. Another Harza Engineering Company's study in 1983 report on the cost effectiveness of Shoccoe Dam, including soil borings.

d. Law Engineering Company's 1981 report on the hydrology and hydraulics of alternative upstream sites.

e. Jim Noblin's 1983 report which contained real estate appraisals for land in the Shoccoe pool and flood damage studies.

f. Engineering Associates, Inc., 1985 report on an evaluation of the 1983 floods and recommendations for improvements in Columbia, Monticello, and Tylertown.

g. Waggoner Engineering, Inc., has conducted numerous topographic surveys and other studies.

The Pearl River Valley Water Supply District, the state agency which owns and operates the Ross Barnett project, retained Harza Engineering Company and Simon, Li, and Associates to redesign the fuse plug emergency spillway at the project and develop computer models for the operation of Ross Barnett Reservoir. The city of Jackson has also conducted numerous studies on the Pearl River. The most pertinent study is the evaluation of the Jackson parkway/levee plan on the west bank of the river from County Line Road to Lakeland Drive. Other municipalities in the Jackson area have retained engineers from time to time to evaluate the impacts of various flood control proposals on their communities. It should be mentioned that all of these studies have been considered in this report.

EXISTING WATER PROJECTS

Jackson Levees

28. The Jackson (Fairgrounds) and East Jackson levees were completed in 1968 by the Corps. The locations of the levees are shown on Plate 1. These protective works consist of two earthen levees, four gated outlets, and two pumping stations. Some 5.34 miles of river channel work was involved in constructing the plan. The Fairgrounds levee protects 420 acres in the fairgrounds area of Jackson on the west side of the river. The longer, East Jackson levee protects 5,870 acres, including the town of Pearl and portions of Flowood and Richland. This project was sponsored by the Rankin-Hinds Pearl River Flood and Drainage Control District, which presently operates and maintains the levees. Maintenance, in addition to maintaining the levee structures, involves periodic removal of vegetation along a 650-foot-wide cleared strip between the levees. In 1984, an extension on the north end of the Fairgrounds levee was constructed to eliminate flanking of the levee, such as occurred during the record flood of April 1979. This extension is approximately 0.2 mile long and protects an additional 380 acres.

29. The Fairgrounds levee top grade was set based on protecting against a 100-year-flood flow of 103,000 cubic feet per second (cfs) with 3 feet of freeboard. Subsequent hydrology studies raised the computed 100-year peak floodflow at Jackson to 111,000 cfs. In view of the increase of the flow for the 100-year flood event, a study was made to determine the adequacy of the levee protection under present conditions. It was found that the new work accomplished in the floodway since 1968 has lowered the elevation of the 100-year flood stage. The levees now provide protection from the revised 100-year flood (111,000 cfs) with about 2.5 feet of freeboard.

30. The original pumping facilities included three 15-cfs pumps at the Fairgrounds levee and three 150-cfs pumps in the East Jackson levee. In 1993, the Rankin-Hinds Pearl River Flood and Drainage Control District added an additional 45 cfs at the Fairgrounds station and an additional 150 cfs at the East Jackson station.

Floodway Clearing

31. The clearing plan which was completed in 1984 extended from about 0.5 mile below the old Jackson sanitary landfill to Woodrow Wilson Bridge, a total of 3.3 river miles. The plan consisted of 237 acres of complete clearing, 20 acres of selective clearing, and 89 acres of partial clearing. Approximately 39,000 tons of riprap were required for protection around bridges. The clearing plan is shown on Plate 2. To offset unavoidable impacts to fish and wildlife associated with the clearing plan, approximately 320 acres of bottom-land hardwood were acquired as mitigation. The PRBDD is the local sponsor for this project.

Excavation at Highway 25 Bridge

32. The modification at Highway 25 bridge consisted of removing material from the west bank of the Pearl River approximately 600 feet upstream and downstream of the bridge to increase the conveyance of the stream at that location. This work was completed by PRBDD in 1983. The location of this work is shown on Plate 2.

Richland Creek Watershed

33. A flood control project for the Richland Creek Watershed was completed in 1991 by SCS under Public Law 83-566. The project included land treatment measures, 3 floodwater-retarding structures, and 17.6 miles of channel work. The plan provides a reduction in headwater flooding along Richland Creek and tributaries and along two relatively small streams in the common flood plain with the Pearl River. The benefits accrue to rural properties, crops, and pasture and urban properties within the city of Richland. Local sponsors are the Richland Creek Watershed Drainage District and Rankin County Soil and Water Conservation District.

Ross Barnett Reservoir

34. The Ross Barnett Reservoir was constructed by the Pearl River Valley Water Supply District, a state-chartered organization, between 1960 and 1962 for the purposes of water supply and recreation. The dam and reservoir location are shown on Plate 2. The earthfill dam is 23,400 feet in length with a maximum height of 64 feet. Elevation at the top of the dam is 308 feet, National Geodetic Vertical Datum (NGVD). The principal spillway consists of ten 40- by 21-foot tainter gates with a discharge capacity of 180,000 cfs. The emergency spillway is a fuse plug type with a discharge capacity of 70,000 cfs.

PLAN FORMULATION

EXISTING CONDITIONS

Physical Setting

35. Basin Characteristics. The Pearl River Basin, as shown on Plate 1, is located in the south-central portion of Mississippi and in a small part of southeastern Louisiana. The river drains an area of 8,760 square miles consisting of all or parts of 23 counties in Mississippi and parts of 3 Louisiana parishes. The Basin has a maximum length of 240 miles and a maximum width of 50 miles. It is bounded on the north by the Tombigbee River Basin, on the east by the Pascagoula River Basin, on the south by Lake Borgne and the Mississippi Sound, and on the west by the Mississippi River Basin and several coastal streams which drain the eastern portion of Louisiana. There are numerous lakes within the Basin, but only a few of significant size. The largest of these is Ross Barnett Reservoir, which is located on the Pearl River about 12 miles northeast of downtown Jackson.

36. Topography and Physiography. The Pearl River Basin lies within the East Gulf Coastal Plain which is physiographically subdivided into the North Central Hills (or Plateau), Jackson Prairie, Southern Pine Hills, and Coastal Pine Meadows districts. These districts cross the Basin generally in a northwesterly direction. Elevations in the Basin range from sea level in the Coastal Pine Meadows Subdivision to approximately 650 feet, NGVD, in the North Central Hills.

37. Geology and Soils.

a. Geologically, the Pearl River Watershed is not a contained unit because the formations extend beyond the topographic divides into adjoining stream basins. The formations at the surface are sedimentary in origin and range in age from early Eocene to Recent.

b. Sand and clay in various proportions constitute nearly all of the immense prism of sedimentary deposits extending from the northern part of the Basin to the coast; a few thin units of marl, limestone, and glauconitic and

lignitic material also are present in several places. Individual sand beds are irregular in thickness and few can be traced more than about 5 miles. However, predominantly sandy zones, as differentiated from predominantly clayey zones, are correlatable over wide areas, some throughout much of the Basin. The formations dip southwestward at 20 to 80 feet per mile throughout the northern three-fourths of the Basin, except where they are interrupted by such structural features as the Jackson Dome and many smaller salt domes. The rate of dip becomes steeper in the southern part of the Basin where pronounced downwarping toward the Mississippi River structural trough has resulted in a dip of 100 feet per mile or more.

38. Stream Characteristics. The Pearl River is formed in Neshoba County, Mississippi, by the confluence of Nanawaya and Tallahaga Creeks and flows southwesterly for 130 miles to the vicinity of Jackson (including the 43-mile-long Ross Barnett Reservoir), then southeasterly for 233 miles to the head of its outlet channels, the Pearl and West Pearl Rivers. The Pearl River has an average fall of approximately 1.0 foot per mile. The river banks, exclusive of the Ross Barnett Reservoir, vary from about 12 to 40 feet high between Edinburg and Jackson and from 20 to 90 feet high between Jackson and the head of the Pearl and West Pearl Rivers. The width of the channel varies from about 100 to 300 feet between Jackson and Edinburg, except for the reach of the Ross Barnett Reservoir, and from about 400 to 1,000 feet below Jackson.

39. Ground Water. Practically all of the ground water is derived from precipitation and reaches the water table through infiltration and percolation. In general, ground water is relatively free from pollution and nearly constant in quality and temperature. The abundant ground-water resources which underlie the Pearl River Basin are generally of good to excellent quality. Aquifers in the Claiborne Group furnish practically all existing ground-water supplies in the northern third of the Basin. Although the underlying Wilcox Group occupies about 1,000 feet of the freshwater section in that area, it is virtually untapped for water supplies due to its greater depth and the availability of adequate water at shallow depths. Beds of Miocene age constitute sources of ground-water supplies throughout the southern two-thirds of the Basin and are the only significant sources in about one-half of the Basin.

40. Climate.

a. Rainfall in the Basin in general is abundant and well distributed throughout the year. Light snowfall in the Basin is not unusual. However, it accounts for only a small part of the annual precipitation. There is some seasonal variation in rainfall, with the heaviest rains usually occurring in the winter and spring and the lightest during the fall. The average annual precipitation over the Basin is about 57 inches, of which 28 percent occurs in the winter, 28 percent in the spring, 26 percent in the summer, and 18 percent in the fall. Normally, the period of greatest monthly precipitation occurs in March or July and the least in October.

b. Prolonged droughts seldom occur in the Basin. The year 1952, with an average basinwide rainfall of a little over 35 inches, was the driest of record. The record wet year was 1979 when the Basin rainfall averaged nearly 84 inches.

c. Storms occurring in the Pearl River Basin include local thunderstorms, or cloudbursts, and general disturbances of the hurricane and frontal types. Summer storms are generally thunderstorms with high intensities over small areas. Flood-producing storms in the winter and spring are usually frontal storms, covering large areas and lasting from 2 to 4 days. Past records indicate that winter storms are likely to be more intense in the northern part of the Basin and summer storms more intense in the southern part.

Hydrologic Setting

41. Prior to 1979, the flood of record was the 1902 flood which had a recorded peak discharge of 85,000 cfs at the Jackson gage. Prior to 1979, the second greatest flood occurred in 1961 with a peak discharge of 66,000 cfs. These record flood levels were far surpassed when the most damaging flood in Jackson's history occurred in April 1979. In a 2-day period between 12-13 April 1979, rainfall amounts measuring up to 19.6 inches fell over the headwaters of the Basin. The resulting flood had a measured peak at the Jackson gage of 128,000 cfs. The resulting peak stage at the Jackson gage was 43.3 feet, NGVD. In May 1983, another severe rainfall in the upper basin generated a peak flow of 78,600 cfs, resulting in a peak stage of 39.5 feet, NGVD, at the Jackson gage. As published by the U.S. Geological Survey (USGS), the frequencies of the 1979 and 1983 flood events at the Jackson gage were 200- and 35-year flood events, respectively.

Environmental Resources

42. Vegetation in the study area is diverse and consists of typical forested wetland/upland tree species associations. Predominant habitat types include bottom-land hardwoods, cypress-tupelo gum brakes, black willow disturbed areas, pines, mixed pine-hardwoods, pasture/old field, cutover, and open water areas.

43. The Pearl River Basin supports high wildlife populations. Despite the presence of man and his various activities between Ross Barnett Reservoir Dam and Byram, the flood plain continues to be a relatively productive area for wildlife. Wildlife species in the study area include white-tailed deer, mourning dove, gray squirrel, cottontail rabbits, swamp rabbits, bobwhite, raccoon, wood duck, migratory waterfowl, and a host of nongame species. Furbearers are also present in the area, and wild turkey may occasionally utilize the area.

Water Quality

44. The city of Jackson depends upon surface water from the Pearl River for its public water supply. Therefore, the segment of the Pearl River between the Ross Barnett Reservoir Dam and the raw water intake structure (RM 290.6) is classified by the Mississippi Bureau of Pollution Control as public water supply. Between the intake structure and Byram, the Pearl River is classified for fish and wildlife.

Fishery Resources

45. The fishery resources of the Pearl River and Ross Barnett Reservoir, as well as those of Mayes Lake (located north of the Illinois Central Gulf Railroad (ICGR) bridge at RM 290.58, and Crystal Lake (located north of U.S. Highway 80) are heavily utilized by sport fishermen. The Mayes Lake area is part of LeFleur's Bluff State Park and is owned, maintained, and operated by the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP). The high quality and proximity of these lakes to a major metropolitan area make fishery resources especially valuable.

Air Quality

46. Air quality for the entire State of Mississippi is considered good. The Jackson area is in total compliance with concentration limits of the National Ambient Air Quality Standards.

Noise

47. Noise problems are limited to those associated with normal day-to-day activities such as air and automobile traffic, construction, and industry. The generation of noise within the proposed study area will be primarily limited to the contribution from automobile traffic over several highway bridges crossing the Pearl River. There are no sources of excessive noise that can cause problems within the proposed study area.

Recreational Opportunities

48. Recreational opportunities within the proposed study area include both consumptive activities such as hunting and fishing and nonconsumptive activities such as hiking, nature study, and outdoor photography. On the west bank of the river, south of Lakeland Drive, is LeFleur's Bluff State Park. This area has been developed primarily for nonconsumptive recreation activities and includes a swimming pool, golf course, tennis courts, picnic areas, playgrounds, and hiking trails. The Mayes Lake area, part of the state park complex, consists of several ponds and oxbow lakes used extensively for fishing and includes easy access and wooden piers for bank fishermen.

Esthetics

49. Much of the proposed study area near Jackson is a forested area void of residential, commercial, or industrial development. The remaining land is visually pleasing, providing diversity to the landscape of the Jackson area. This greenbelt provides a visually relaxing atmosphere for those persons wishing to escape the asphalt and concrete of the nearby Jackson Metropolitan Area.

Cultural Resources

50. A cultural resources survey was completed on the Jackson Metropolitan Study area. Details of these investigations are presented in Appendix 3. Sixty-one archeological/historical sites were assessed within the project vicinity. Six of those sites have been determined to be either potentially eligible for listing in the National Register of Historic Places (NRHP) or have been listed in the NRHP.

Endangered Species

51. The Corps requested a list of endangered or threatened species that may occur within the study area in a letter dated 23 August 1989. The records indicate that the endangered bald eagle is known to occur in the area of the Ross Barnett Reservoir and that the threatened ringed sawback turtle, a species known only from the Pearl River system, has been collected in the study area.

Development and Economy

52. Socioeconomic Characteristics. The following discussion presents information on the demographic and economic characteristics of Hinds and Rankin Counties, Mississippi. Madison County was not included since less than 1 percent of the county is within the study area. A more detail discussion of socioeconomic characteristics is presented in Appendix 6.

53. Population. Data from the 1990 Census show a population of 342,000 in the two-county area, an increase of 6.7 percent since 1980. Significantly, this two-county area contained 13.3 percent of the state's 1990 population. Especially strong growth occurred in Rankin County, with a 58 percent increase from 1970 to 1980 and 26.3 percent from 1980 to 1990.

54. Income. With the economic growth in the area, major changes have occurred in the income of the two counties. The 1990 per capita income (PCI) figures for each county showed increases in excess of 70 percent over the 1980 numbers. Rankin County's gain was 80.5 percent (from \$8,180 to \$14,765), with Hinds County increasing 72 percent from \$9,151 to \$15,753.

FUTURE WITHOUT-PROJECT CONDITIONS

Environmental Setting

55. The land use of the study area is expected to change little during the anticipated project life. Flood plain zoning restrictions and local experience with flooding will minimize further encroachment into the flood plain. Urbanization is projected to claim approximately 5 percent of undeveloped areas during the project life. Land use practices on woodland areas will continue with landowners allowing forest succession to occur for future timber production. Wildlife population on these lands is projected to remain high. Federal and state water quality requirements are expected to have a stabilizing effect on water quality in the study area.

Hydrologic Setting

56. Without additional flood protection along the Pearl River, periodic flooding will continue to plague residential areas, commercial businesses, industries, and local infrastructure. Little change is expected in the streambed due to sediment deposition or erosion. No change is foreseen in the operation of the Ross Barnett Reservoir which is assumed to function as a run-of-river structure for this study.

PROBLEMS AND OPPORTUNITIES

Flooding

57. The study area is primarily affected by headwater flooding caused by the Pearl River. Headwater flooding is caused by unusually heavy and intense rainfall over the upper Pearl River Basin.

58. Prior to 1979, the flood of record was the 1902 flood which had a recorded peak discharge of 85,000 cfs at the Jackson gage. The modern day flood of record had occurred in 1961 with a peak discharge of 66,000 cfs. These record flood levels were far surpassed by the events of 1979 and 1983. The worst flood in Jackson's history occurred in 1979. In a 2-day period between 12-13 April 1979, rainfall in amounts measuring up to 19.6 inches fell over the headwaters of the Basin. The resulting flood had a measured peak at the Jackson gage of 128,000 cfs measured at the gage in Jackson. Flood damages in Jackson were devastating. In May 1983, another severe rainfall in the upper Basin generated a peak flow at 78,600 cfs at the Jackson gage. The frequencies of the 1979 and 1983 flood events are estimated to be, respectively, 200- and 35-year flood events at the Jackson gage. Because of the

severity of these two floods, other floods which occurred between 1979 and 1983 are rarely mentioned. For the record, floods with frequencies of 5 to 10 years occurred on 21 March 1980, 14-17 April 1981, 6 December 1982, and 8-9 April 1983. This repeated flooding over the 4-year period caused a great deal of trauma to the citizens of Jackson and explains their intense interest in flood control.

59. During the 1979 flood, there were 1,935 houses and 775 businesses flooded. Damages to these properties were especially severe because the river was above flood stage from 10 to 14 days in some areas. This caused serious disruptions to transportation and communications and stymied the capital city for weeks. In fact, many of the flood victims interviewed indicated that it took 6 months to 1 year for things to get back to normal.

60. The total physical property damage caused by the 1979 flood was estimated at \$233 million in 1979 dollars. Although this flood was devastating, it should be emphasized that it could have been much worse if it were not for some well executed emergency flood-fighting activities. First, the Ross Barnett project, a water supply and recreation lake with no dedicated flood control storage, was used beyond its normal limits to regulate floodflows and reduce the peak flow in Jackson by 17,000 cfs. Had the storm pattern been different or the flood forecasts not been exceptionally accurate, this would not have been possible. Secondly, the Federal flood control levees in Jackson were designed for a 100-year flood flow of 103,000 cfs (the peak flow in 1979 was 128,000 cfs). The Fairground levee on the west side of the river was flanked on the north end, thereby flooding the area behind the levee. However, the East Jackson levee held because of a monumental sandbagging effort when the floodwaters were lapping at the top of the levee. Had the East Jackson levee been overtopped, there would have been an additional 1,065 homes and 293 businesses flooded. Flood damages in that event would have been about \$535 million in 1984 dollars, an increase of about \$235 million.

Fish and Wildlife

61. Due to the increased urban environment, suitable habitat for fish and wildlife is being reduced. As urban growth continues in the study area, fish and wildlife habitat areas may be further reduced unless preservation measures are undertaken by local interests. The need exists to protect and enhance fish and wildlife habitat.

Recreation

62. There is a need to provide the local citizens of the study area opportunities to participate in nonconsumptive uses of the area's natural resources such as hiking, picnicking, nature photography, birdwatching, canoeing, nature trails, etc. Such recreational areas could be developed in conjunction with the selected plan for providing flood protection to the area.

PLANNING OBJECTIVES

63. In accordance with the Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G), the Federal objective of water and related land resources planning is to contribute to National Economic Development (NED) consistent with protecting the nation's environment pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

64. As a result of the problem identification process, the objectives listed below formed the basis for the formulation of preliminary alternative plans. These objectives are in consonance with the intent of the P&G and other planning guidance.

a. Reduce flood damages to existing development with the Jackson Metropolitan study area.

b. Minimize adverse environmental impacts through project design.

c. Compensate 100 percent for unavoidable environmental impacts.

PLANNING CONSTRAINTS

General

65. The formulation of alternatives for this study was influenced by the previous feasibility studies completed in 1985. Rather than evaluating a full array of alternatives, information from the feasibility study was utilized to determine the most likely alternative to the Shoccoe Dam project.

Formulation and Evaluation Criteria

66. Alternatives were formulated and evaluated in accordance with various technical, economic, environmental, and socioeconomic criteria. When applied, these criteria provide the means for responding to the problems and opportunities of the area by selecting a plan in the best public interest, consistent with other developments in the area, and developing an economically feasible solution.

67. Federal policy on multiobjective planning derived from both legislative and executive authorities establishes and defines the national objectives for water resource planning, specifies the range of impacts that must be assessed, and sets forth the conditions and criteria which must be applied when evaluating plans. Plans must be formulated considering benefits and costs, both tangible and intangible, and effects on the environment and social well-being of the community.

68. Plan formulation criteria include published regulations and principles adopted by the Water Resources Council and the Corps regulations. Other criteria used are in compliance with the P&G, National Environmental Policy Act (NEPA), and Executive Orders 11988 and 11990.

Technical Criteria

69. The Ross Barnett Reservoir will operate as a run-of-river dam and no reduction of peak discharges would be reduced by the reservoir. This criterion is consistent with previous Corps flood control evaluations in the Jackson Metropolitan area.

70. The economic life of the project was assumed to be 100 years for levee projects and 50 years for other alternatives.

71. Unavoidable environmental losses will be mitigated to the extent practicable.

Economic Criteria

72. Benefits and cost should be expressed in comparable terms as fully as possible. Evaluations of alternatives were based on May 1993 price levels. The selected plan is presented at October 1994 price levels.

73. Each alternative considered in detail must be justified so total beneficial effects (monetary and nonmonetary) associated with the objectives are equal to or exceed the total adverse effects (monetary and nonmonetary) associated with the objectives.

74. Economic impacts and sizing of levee alternatives will be based upon the risk analysis procedures described in Engineer Circular 1105-2-205, 25 February 1994.

Environmental Criteria

75. Plans should be formulated to the extent practicable to preserve or improve the quality of the natural environment.

76. Fish and wildlife mitigation features are to be undertaken concurrently with project features.

Socioeconomic Criteria

77. Consideration should be given to evaluating and preserving historical, archeological, and other cultural resources.

78. Consideration should be given to safety, health, community cohesion, and social well-being.

79. Displacement of people by the floods and/or the project should be minimized to the extent practicable.

PRELIMINARY SCREENING

80. A broad range of flood damage reduction measures was considered in the screening process during the reconnaissance studies and previous feasibility studies by the Mobile District in their Pearl River Basin Interim Report on Flood Control, July 1985.

81. The affected public provided assistance in identifying other alternatives to be evaluated. A scoping meeting was held in Jackson to outline the study procedures and receive public input concerning the study process and problems in the area.

82. During the early stages of the feasibility study, a review was made of existing Corps data and prior studies of the known flooding problems throughout the Pearl River Basin. Other flood problems identified included areas in Columbia, Mendenhall, and Carthage, Mississippi. Coordination with the project sponsor and SCS resulting in no further consideration of these areas by the Corps at the present time since recent Corps investigations in these areas were negative. SCS is pursuing investigation in each of these areas.

83. Alternatives identified in the reconnaissance study to provide flood protection to the Jackson Metropolitan area include no-action, nonstructural, and structural measures. These alternatives are discussed in the following paragraphs.

No-Action Alternative

84. A no-action alternative was considered, but it would not eliminate any of the damages the metropolitan area has historically experienced. This would result in continued flood damage, trauma, and serious disruptions to human endeavors in the capital area and associated impacts to the entire State of Mississippi.

Nonstructural Alternatives

85. All practicable nonstructural measures to reduce flood damages were considered in the early screening of alternatives. While some were eliminated during early formulation of alternatives, others were evaluated in detail to determine if a combination of structural and nonstructural measures would comprise the best solution for the overall project.

86. Basically, two types of nonstructural measures for flood protection exist--those which reduce existing damages and those which reimburse for existing damages and reduce future damage potential. Those nonstructural measures which reduce damages and were investigated to varying degrees in this study include the following:

- a. Floodproofing by waterproofing of walls and openings in structures.
- b. Raising structures in place.
- c. Constructing walls or levees around structures.
- d. Permanent flood plain evacuation.

- (1) Relocate structures and contents to flood-free area.

- (2) Relocate contents and demolish structures. Provide replacement housing.

- e. Flood forecasting and warning systems with temporary evacuation.

87. Nonstructural measures which compensate or reimburse for existing damages and/or reduce future damages include:

- a. Acquisition of flood-prone property.
- b. Flood plain regulation by zoning ordinances, regulations, and building codes.
- c. Flood insurance.

88. Residential, commercial, and public structures in the flood plain are primarily slab-on-grade construction. Raising such structures through normal jacking procedures is impractical; therefore, raising structures in place and relocating structures outside the flood plain are not viable. Constructing walls or levees around structures would be impractical due to depth of flooding and the closeness of structures in our urban area.

89. Floodproofing would provide only limited protection and is not economically justified.

90. One nonstructural alternative was evaluated during previous studies by the Mobile District. This plan consisted of relocation of occupants and/or structures from the 10-year flood plain. This plan was not economically justified. This plan alone would directly benefit only a few families and businesses and does relatively little to solve the flood problem at Jackson. The city of Jackson applied for Federal funds to purchase six properties in the flood plain in northeast Jackson under Section 1362 of Public Law 90-448. All the owners subsequently decided not to sell.

91. An enhanced flood warning (forecasting) system is operated by the Jackson-Hinds Emergency Operations Center. Flood warnings are issued by the National Weather Service. Local governments are responsible for evacuation. In Jackson, the Police Department is the lead agency in evacuation efforts.

In the other municipalities, emergency procedures are handled by the mayors' offices. Flood plain management ordinances in all the communities in the Jackson area meet Federal standards.

Structural Flood Control Alternatives

92. Levee Plans.

a. During screening of plans for the feasibility study, costs were developed for six levee plans. These plans consisted of levees in Northeast Jackson, Lakeland Drive and Eubanks Creek, Belhaven Creek, Town and Lynch Creeks, South Jackson, Byram, Laurelwood and Flowood, and Richland and raising the existing Fairgrounds and East Jackson levees. The location of these levee segments is shown on Plate 3. These plans were designated as Plans A-1, A-2, B-1, B-2, C-1, and C-2. Levee Plans A-1, B-1, and C-1 consisted of opposite borrow (borrow alongside the levee). Plans A-2, B-2, and C-2 consisted of satellite borrow areas. All levee plans included adequate interior drainage facilities where the levees would block existing drainage.

b. Plans A-1 and A-2 each provided 100-year protection. Plans B-1 and B-2 each provided protection equivalent to the 1979 flood frequency. Plans C-1 and C-2 each provided 500-year protection. Benefits were not affected by the type of borrow.

c. Levee alignments were established to provide protection to all existing development practicable while minimizing the amount of flood plain protected by the levee. This eliminated the opportunity to evaluate a wide array of alignments. The levees were located as close as possible to the existing development while maintaining adequate storage volume within the leveed area for interior runoff. During sizing of the interior drainage facilities, some minor alignment changes were necessary. Minor alignment changes were also made during the evaluation of plans to avoid significant archeological sites and environmentally sensitive areas. However, the proximity of the existing development to the flood plain simply did not provide for an analysis of varied levee alignments.

d. Each plan consists of a segment of floodwall between the Eubanks Creek levee segment and the Northeast Jackson levee segment. This area is adjacent to the LeFleur's Bluff State Park. A levee segment along the river was considered and coordinated with MDWFP. This levee segment would have to be located across the middle of the park camping area and was unacceptable to MDWFP. A floodwall adjacent to the existing development along Lakeland Drive was the only other alternative.

e. A levee segment at Byram was considered during the reconnaissance study and during the early stages of the feasibility study. Damages in this area were not enough to incrementally justify a levee at this location. An analysis of downstream impacts of the proposed levee indicated that the project would not significantly increase stages in the Byram area. As a result, the Byram segment was eliminated from further consideration.

f. Each of the six plans consisted of bendway and overbank clearing between RM 290.7 and 301.7. This clearing was determined to be necessary to minimize the increase in flood stages between the levees above Lakeland Drive. The spillway of Ross Barnett Reservoir utilizes tainter gates to regulate releases. These gates are sensitive to tailwater effects. In order to not affect the release capability of the reservoir, it was necessary to incorporate this minimal amount of clearing. Channel excavation was not considered as an option due to the potential impact it would have on sandbars, which are critical habitat for the ringed sawback turtle. Approximately 168 acres of woodlands will be cleared and maintained to provide more efficient overbank flow in this area. Approximately 74 acres, which were previously cleared at certain bendways by the city, will be maintained.

g. Gravity drainage floodgates are required at numerous locations through the levee. These consisted of 9 box structures and 9 pipe structures. These structures provided adequate outlet capacity to prevent blocked drainage as a result of constructing the levees. Pumping facilities were considered as additional flood reduction measures and are addressed separately.

h. Both levee berms and slurry trenches were considered as measures for preventing underseepage along the proposed levees. Slurry trenches were selected as the preferred measure based on high land prices and environmental considerations.

i. Mitigation requirements were developed based on analysis of impacts to terrestrial wildlife. Fisheries and waterfowl impacts were determined to be insignificant with the proposed measures. Compensation requirements were developed based on acquisition of bottom-land hardwoods, acquisition and restoration of frequently flooded cleared lands by natural succession, and acquisition and reforestation of frequently flooded cleared lands with plantings of bottom-land hardwoods. Based on compensation requirements and costs, reforestation was the preferred method of compensation. A detail presentation of the compensation analysis is presented in Appendix 2.

j. A summary of the physical features of the six levee plans is presented in Table 1. Costs of the six levee plans are presented in Table 2. Based on the cost analysis, total satellite or offsite borrow was eliminated from further consideration. The costs of the remaining three basic levee plans were used to develop a cost curve for an array of levee heights that were evaluated using the new risk analysis procedures.

TABLE 1
PHYSICAL FEATURES OF LEVEE ALTERNATIVES

Plan	Levee Embankment (cubic yards)	Borrow Area (acres)	Slurry Trench (feet)	Total Right-of-Way (acres)	Mitigation (acres)
A-1	4,319,000	477	29,100	1,289	1,001
A-2	4,319,000	350	29,100	1,016	694
B-1	6,768,000	717	51,600	1,615	1,212
B-2	6,768,000	561	51,600	1,236	901
C-1	7,529,000	783	51,600	1,700	1,283
C-2	7,529,000	641	51,600	1,378	977

TABLE 2
FIRST COST OF ALTERNATIVE PLANS
(\$000)

Plan	Real Estate	Construction	Mitigation	Total First Cost
A-1	21,861	44,600	1,633	68,094
A-2	20,734	49,707	1,177	71,618
B-1	22,981	53,367	1,962	78,310
B-2	21,437	60,845	1,563	83,845
C-1	23,916	56,810	2,049	82,775
C-2	22,476	65,081	1,654	89,211
D-1	1,524	4,395	2,068	7,987
D-2	799	3,195	969	4,963
E-1	2,850	8,687	3,584	15,121
E-2	1,895	6,786	1,665	10,346

93. Clearing Plans. Four clearing plans were also evaluated as separate alternatives (Figures 1-4). These plans consisted of varying degrees of clearing between RM 278.8 and 292.6. These plans were identified as Plans D-1, D-2, E-1, and E-2. Plan D-1 included total clearing of the flood plain between RM 278.8 and 285.3 while D-2 consisted of selected clearing of this same area. Plan E-1 consisted of total clearing of the flood plain between RM 287.6 and 292.6, plus the area of Plan D-1. Plan E-2 consisted of selected clearing between RM 287.6 and 292.6, plus the area of selective clearing in Plan D-2. These plans are extensions of the existing clearing that was accomplished by the Corps in 1984. Costs for the four clearing plans are presented in Table 2. Physical features of the plans are depicted in Table 3.

LAKELAND DR.
HWY 25
(RM 292.63)

ICG RR
(RM 290.58)

I-55 & US-49
(RM 288.27)

OLD BRANDON RD
(RM 287.55)

AUTHORIZED CLEARING
PLAN

(RM 285.3)

(RM 278.83)



SCALE 1" = 4000'
0' 4000' 8000'

LEGEND

===== LEVEE

----- LIMITS OF
CLEARING PLAN

NO CLEARING

TOTAL CLEARING

FIGURE 1
PLAN D-1

Vicinity of JACKSON, MS

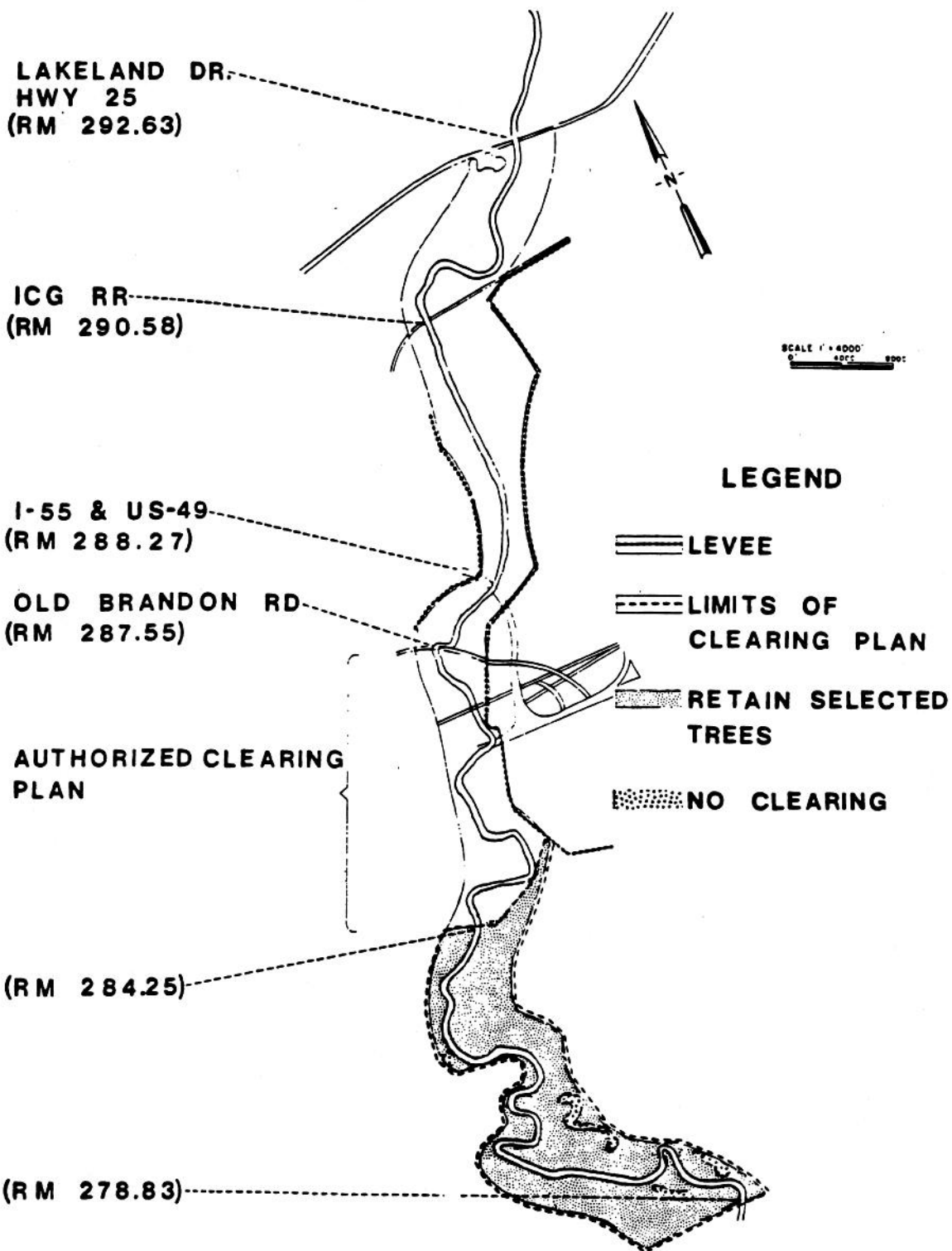


FIGURE 2
PLAN D-2

Vicinity of JACKSON, MS